



TFT LCD Tentative Specification

MODEL NO.: N140O6 - L02

Customer:

Approved by:

Note:

記錄	工作	審核	角色	投票
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Tentative**REVISION HISTORY**

Version	Date	Page (New)	Section	Description
0.0	Sep. 02,'08	All	All	Tentative specification was first issued.



1 GENERAL DESCRIPTION

1.1 OVERVIEW

N140O6 - L02 is a 14.0" TFT Liquid Crystal Display module with LED Backlight unit and 40 pins LVDS interface. This module supports 1600 x (3 RGB) x 900 WXGA+ mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The converter module for backlight is built in.

1.2 FEATURES

- Thin and Light Weigh
- HD+ (1600 x 900 pixels) resolution
- DE only mode
- 3.3V LVDS (Low Voltage Differential Signaling) interface with 2 pixel/clock
- RoHS compliance

1.3 APPLICATION

- TFT LCD Notebook

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	309.60(H) X 174.15(V) (14.0 inch Diagonal)	mm	(1)
Bezel Opening Area	314.04 (H) x 177.35 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1600 x R.G.B. x 900	pixel	-
Pixel Pitch	0.1935 (H) x 0.1935 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Glare (3H min.)	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	323	323.5	324.0	mm	(1)
	Vertical(V)	191.5	192	192.5	mm	
	Depth(D)	--	5.2	5.4	mm	
Weight		--	--	(375)	g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions

2 ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

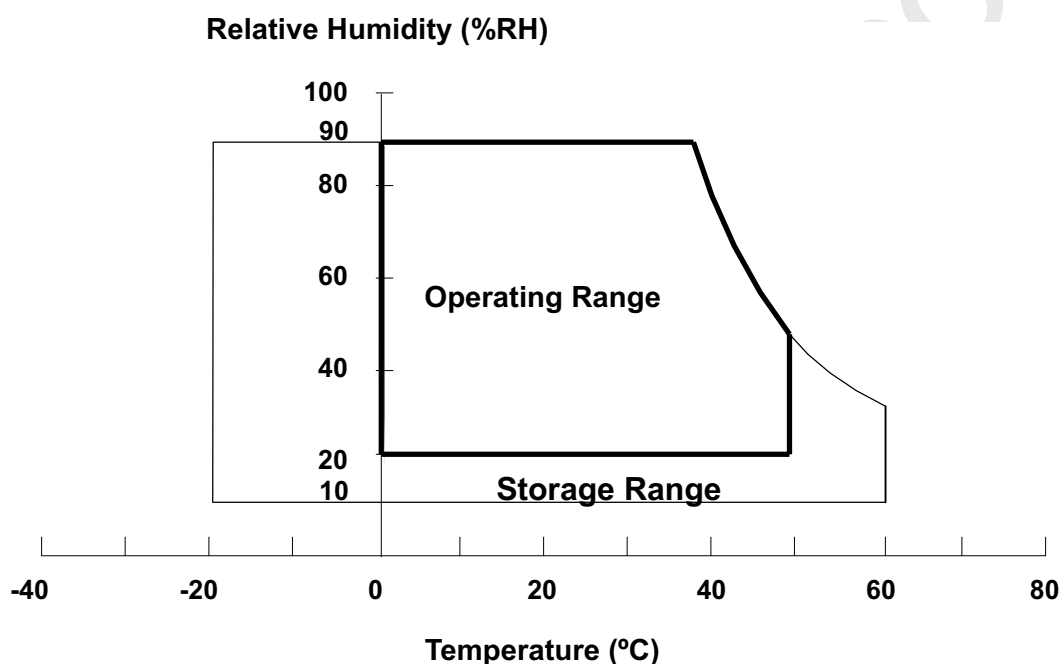
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	+60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	+50	°C	(1), (2)
Shock (Non-Operating)	S _{NOP}	-	220/2	G/ms	(3), (5)
Vibration (Non-Operating)	V _{NOP}	-	1.5	G	(4), (5)

Note (1) (a) 90 %RH Max. (Ta ≤ 40 °C).

(b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).

(c) No condensation.

Note (2) The temperature of panel display surface area should be 0 °C Min. and 60 °C Max..

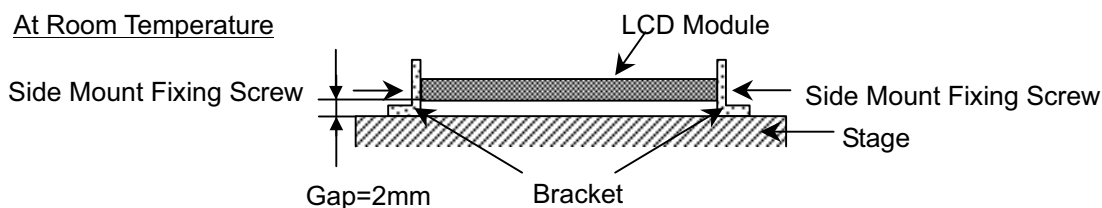


Note (3) 1 time for ± X, ± Y, ± Z. for Condition (220G / 2ms) is half Sine Wave..

Note (4) 10 ~ 500 Hz, 30 min / Cycle, 1 cycles for each X, Y, Z axis.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:





2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V _{CC}	-0.3	+4.0	V	(1)
Logic Input Voltage	V _{IN}	-0.3	V _{CC} +0.3	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
LED Light Bar Power Supply Voltage	V _L	0	(31.5)	V	(1), (2)
LED Light Bar Power Supply Current	I _L	0	(150)	mA	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for LED (Refer to 3.2 for further information).

3 ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

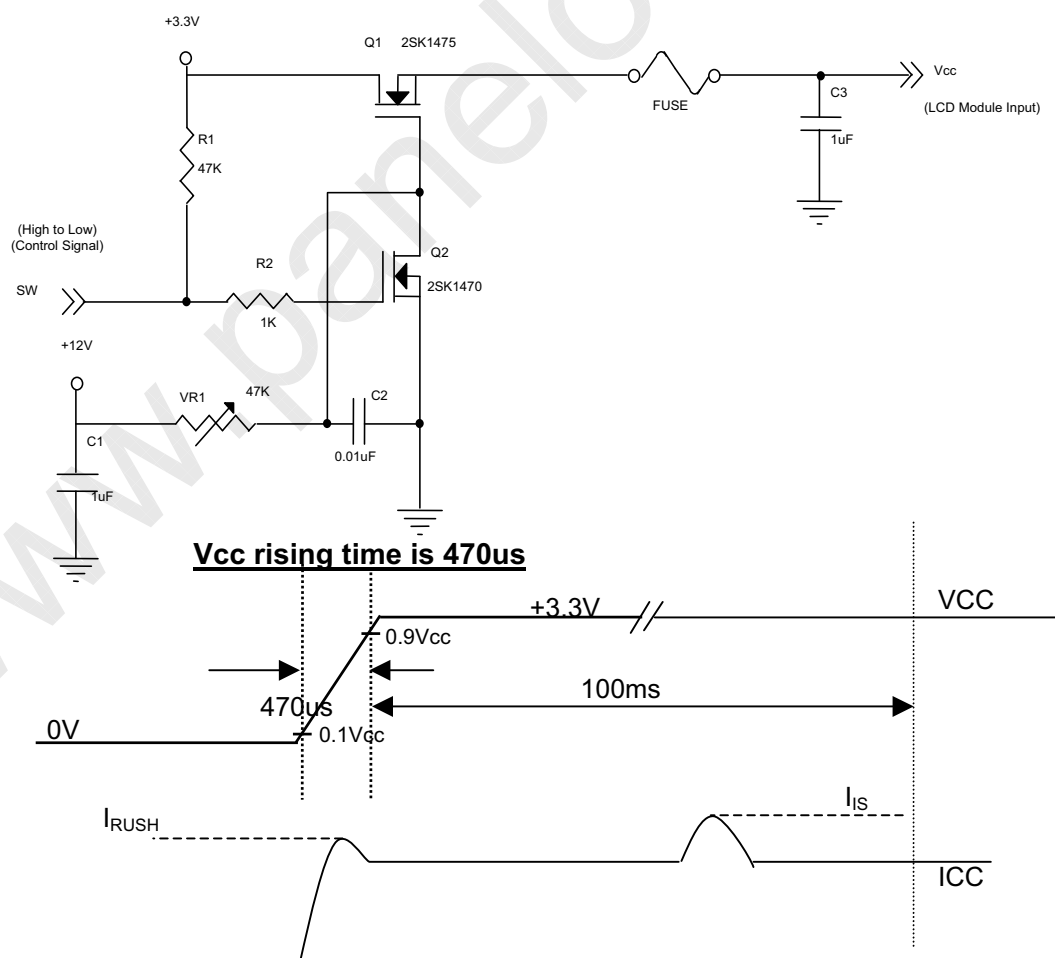
Ta = 25 ± 2 °C

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	V _{CC}	3.0	3.3	3.6	V	-
Permissible Ripple Voltage	V _{RP}		50		mV	-
Rush Current	I _{RUSH}			1.5	A	(2)
Initial Stage Current	I _{IS}			1.0	A	(2)
Power Supply Current	White	I _{CC}	TBD		mA	(3)a
	Black		TBD		mA	(3)b
LVDS Differential Input High Threshold	V _{TH(LVDS)}			+100	mV	(5), V _{CM} =1.2V
LVDS Differential Input Low Threshold	V _{TL(LVDS)}	-100			mV	(5), V _{CM} =1.2V
LVDS Common Mode Voltage	V _{CM}	1.125		1.375	V	(5)
LVDS Differential Input Voltage	V _{ID}	100		600	mV	(5)
Terminating Resistor	R _T		100		Ohm	
Power per EBL WG	P _{EBL}	-	TBD	-	W	(4)

Note (1) The ambient temperature is Ta = 25 ± 2 °C.

Note (2) I_{RUSH}: the maximum current when V_{CC} is risingI_{IS}: the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure. Test pattern: black





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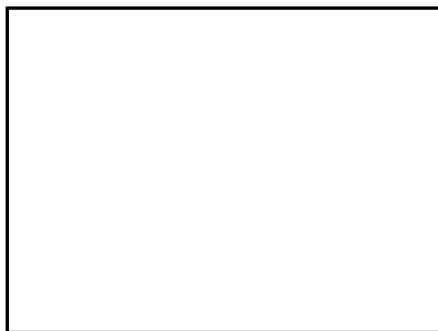
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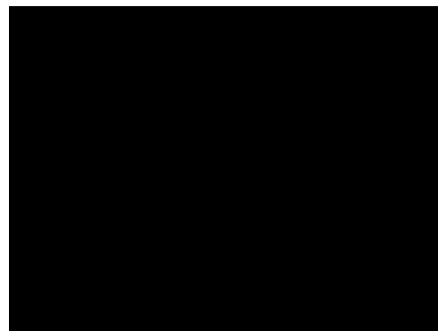
Note (3) The specified power supply current is under the conditions at $V_{CC} = 3.3\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



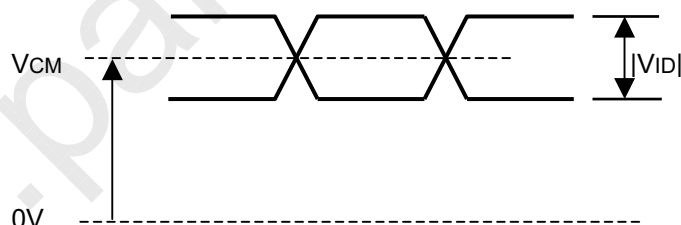
Active Area

Note (4) The specified power are the sum of LCD panel electronics input power and the converter input power. Test conditions are as follows.

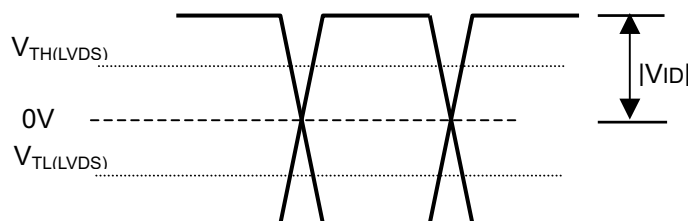
- (a) $V_{CC} = 3.3\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, $f_v = 60\text{ Hz}$,
- (b) The pattern used is a black and white 32 x 36 checkerboard, slide #100 from the VESA file "Flat Panel Display Monitor Setup Patterns", FPDMSU.ppt.
- (c) Luminance: 60 nits.

Note (5) The parameters of LVDS signals are defined as the following figures.

Single Ended



Differential





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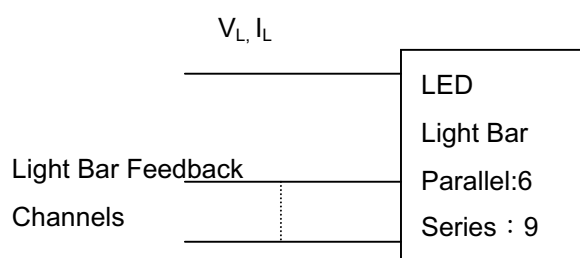
Tentative

3.2 BACKLIGHT UNIT

Ta = 25 ± 2 °C

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Quantity		54			Pcs	(1),
LED light bar Power Supply Voltage	V _L	30	(28.8)	(31.5)	V _{dc}	(1), (2)
LED light bar Power Supply Current	I _L	--	(120)	---	mA	
LED Life Time	L _{BL}	15,000	-	-	Hrs	(4)
Power Consumption	P _O	-	(3.456)		W	(3), I _L = 120.0 mA

Note (1) LED light bar configuration is shown as below:



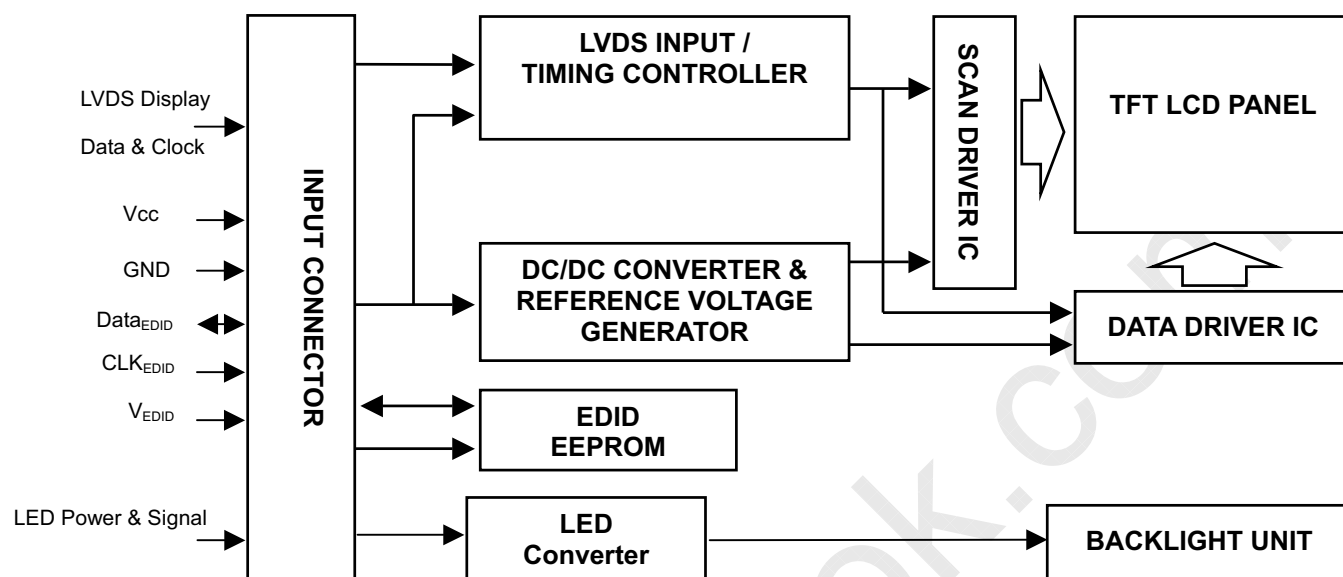
Note (2) For better LED light bar driving quality, it is recommended to utilize the adaptive boost converter with current balancing function to drive LED light-bar.

Note (3) $P_O = I_L \times V_L$

Note (4) The lifetime of LED is defined as the time when it continues to operate under the conditions at Ta = 22 ± 2 °C and I_L = 20 mA(Per EA) until the brightness becomes ≤ 50% of its original value.

4 BLOCK DIAGRAM

4.1 TFT LCD MODULE





5 INPUT TERMINAL PIN ASSIGNMENT

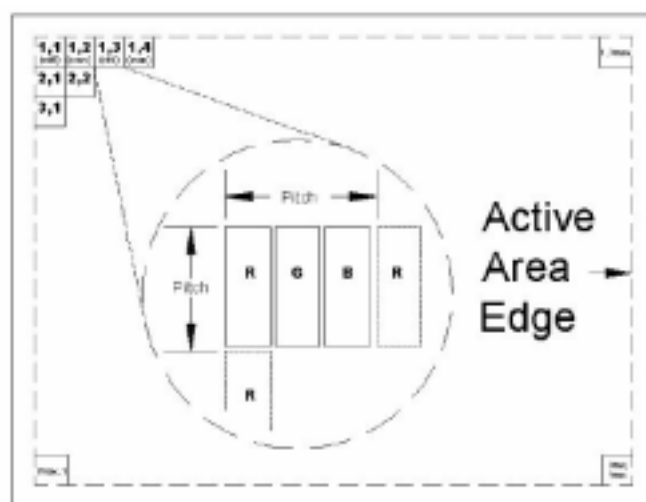
5.1 TFT LCD MODULE

Pin	Symbol	Description	Polarity	Remark
1	DIAG_LOOP	Connect to Pin34 for test		
2	VDD	Power Supply +3.3 V		
3	VDD	Power Supply +3.3 V		
4	V EEDID	DDC +3.3 V		
5	TEST	Panel Self Test		
6	Clk EEDID	DDC Clock		
7	DATA EEDID	DDC Data		
8	Odd_Rin0-	LVDS Differential Data Input (Odd)	Negative	
9	Odd_Rin0+	LVDS Differential Data Input (Odd)	Positive	
10	VSS	Ground		
11	Odd_Rin1-	LVDS Differential Data Input (Odd)	Negative	
12	Odd_Rin1+	LVDS Differential Data Input (Odd)	Positive	
13	VSS	Ground		
14	Odd_Rin2-	LVDS Differential Data Input (Odd)	Negative	
15	Odd_Rin2+	LVDS Differential Data Input (Odd)	Positive	
16	VSS	Ground		
17	Odd_ClkIN-	LVDS Clock Data Input (Odd)	Negative	
18	Odd_ClkIN+	LVDS Clock Data Input (Odd)	Positive	
19	VSS	Ground		
20	Even_Rin0-	LVDS Differential Data Input (Even)	Negative	
21	Even_Rin0+	LVDS Differential Data Input (Even)	Positive	
22	VSS	Ground		
23	Even_Rin1-	LVDS Differential Data Input (Even)	Negative	
24	Even_Rin1+	LVDS Differential Data Input (Even)	Positive	
25	VSS	Ground		
26	Even_Rin2-	LVDS Differential Data Input (Even)	Negative	
27	Even_Rin2+	LVDS Differential Data Input (Even)	Positive	
28	VSS	Ground		
29	Even_ClkIN-	LVDS Clock Data Input (Even)	Negative	
30	Even_ClkIN+	LVDS Clock Data Input (Even)	Positive	
31	VSSLED	Ground		
32	VSSLED	Ground		
33	VSSLED	Ground		
34	DIAG_LOOP	Diag pin for Dell testing. Pin 1 & 34 must be connected together on the inverter board		
35	PWM	PWM brightness control		
36	LED_EN	BL On/Off		
37	NC	NC		
38	VDDLED	6V-21V LED Power		
39	VDDLED	6V-21V LED Power		
40	VDDLED	6V-21V LED Power		

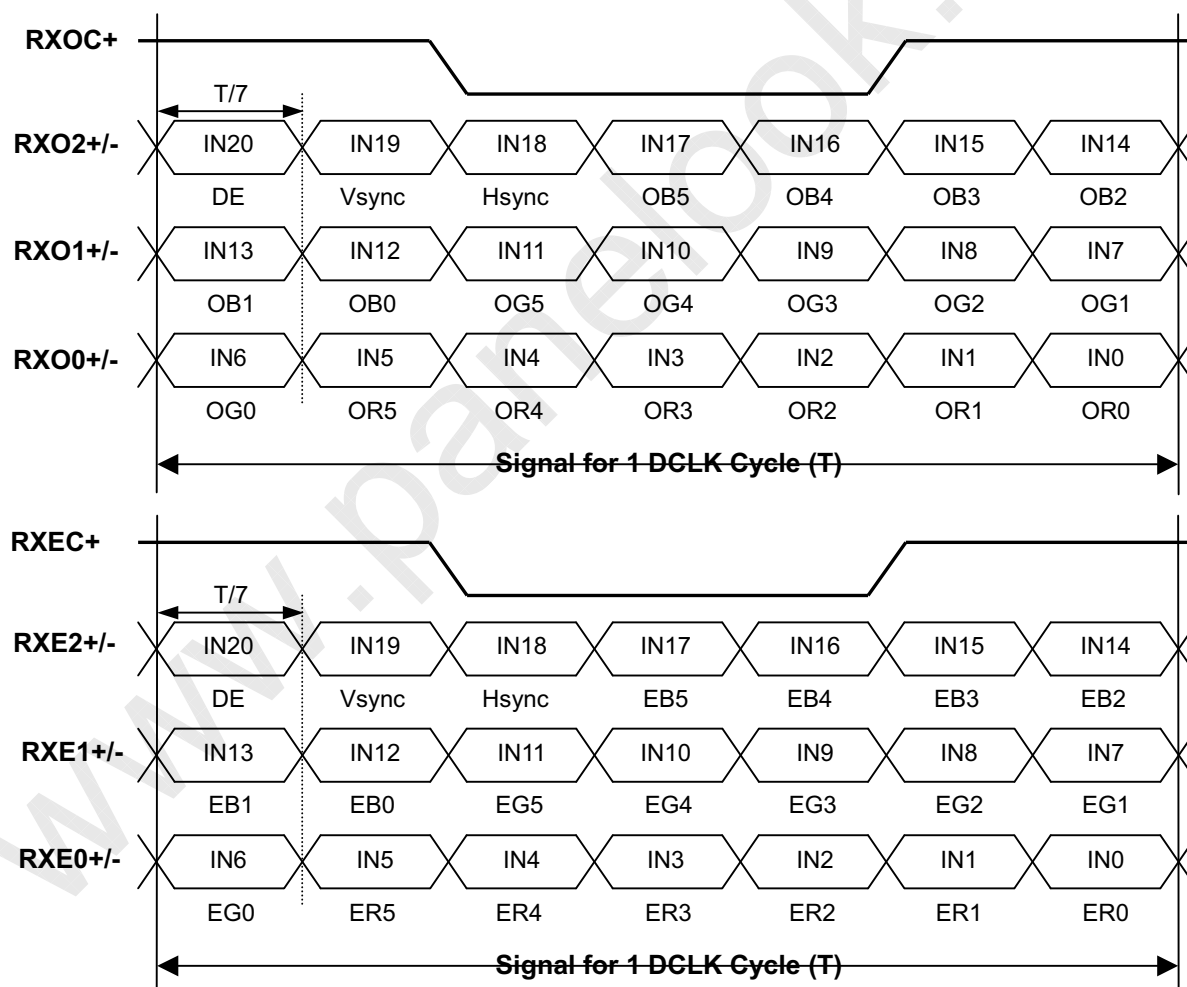
Note (1) Connector Part No.: I-PEX 20455-040E-12 or equivalent

Note (2) User's connector Part No: I-PEX 20453-040T-01 or equivalent

Note (3) The first pixel is odd as shown in the following figure.



5.2 TIMING DIAGRAM OF LVDS INPUT SIGNAL




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5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	

Note (1) 0: Low Level Voltage, 1: High Level Voltage

5.4 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPD1 standards.

Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
0	0	Header	00	00000000
1	1	Header	FF	11111111
2	2	Header	FF	11111111
3	3	Header	FF	11111111
4	4	Header	FF	11111111
5	5	Header	FF	11111111
6	6	Header	FF	11111111
7	7	Header	00	00000000
8	8	EISA ID manufacturer name ("CMO")	0D	00001101
9	9	EISA ID manufacturer name (Compressed ASCII)	AF	10101111
10	0A	ID product code (N140O6-L02)	47	01000111
11	0B	ID product code (hex LSB first; N140O6-L02)	14	00010100
12	0C	ID S/N (fixed "0")	00	00000000
13	0D	ID S/N (fixed "0")	00	00000000
14	0E	ID S/N (fixed "0")	00	00000000
15	0F	ID S/N (fixed "0")	00	00000000
16	10	Week of manufacture	04	00000100
17	11	Year of manufacture	13	00010011
18	12	EDID structure version # ("1")	01	00000001
19	13	EDID revision # ("3")	03	00000011
20	14	Video I/P definition ("digital")	90	10010000
21	15	Active area horizontal 30.96cm	1F	00011111
22	16	Active area vertical 17.415cm	11	00010001
23	17	Display Gamma (Gamma = "2.2")	78	01111000
24	18	Feature support ("Active off, RGB Color")	0A	00001010
25	19	Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0	A5	10100101
26	1A	Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0	78	01111000
27	1B	Rx=0.6154	9D	10011101
28	1C	Ry=0.3377	56	01010110
29	1D	Gx=0.3252	53	01010011
30	1E	Gy=0.6067	9B	10011011
31	1F	Bx=0.169	2B	00101011
32	20	By=0.0809	14	00010100
33	21	Wx=0.3186	51	01010001
34	22	Wy=0.3283	54	01010100
35	23	Established timings 1 (1600*900@60Hz)	00	00000000
36	24	Established timings 2	00	00000000
37	25	Manufacturer's reserved timings	00	00000000
38	26	Standard timing ID # 1	01	00000001
39	27	Standard timing ID # 1	01	00000001
40	28	Standard timing ID # 2	01	00000001


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41	29	Standard timing ID # 2	01	00000001
42	2A	Standard timing ID # 3	01	00000001
43	2B	Standard timing ID # 3	01	00000001
44	2C	Standard timing ID # 4	01	00000001
45	2D	Standard timing ID # 4	01	00000001
46	2E	Standard timing ID # 5	01	00000001
47	2F	Standard timing ID # 5	01	00000001
48	30	Standard timing ID # 6	01	00000001
49	31	Standard timing ID # 6	01	00000001
50	32	Standard timing ID # 7	01	00000001
51	33	Standard timing ID # 7	01	00000001
52	34	Standard timing ID # 8	01	00000001
53	35	Standard timing ID # 8	01	00000001
54	36	Detailed timing description # 1 Pixel clock ("97.75MHz", According to VESA CVT Rev1.1)	2F	00101111
55	37	# 1 Pixel clock (hex LSB first)	26	00100110
56	38	# 1 H active ("1600")	40	01000000
57	39	# 1 H blank ("160")	A0	10100000
58	3A	# 1 H active : H blank ("1600 : 160")	60	01100000
59	3B	# 1 V active ("900")	84	10000100
60	3C	# 1 V blank ("26")	1A	00011010
61	3D	# 1 V active : V blank ("900 :26")	30	00110000
62	3E	# 1 H sync offset ("48")	30	00110000
63	3F	# 1 H sync pulse width ("32")	20	00100000
64	40	# 1 V sync offset : V sync pulse width ("3 : 5")	35	00110101
65	41	# 1 H sync offset : H sync pulse width : V sync offset : V sync width ("48: 32 : 3 : 5")	00	00000000
66	42	# 1 H image size ("310 mm")	36	00110110
67	43	# 1 V image size ("174 mm")	AE	10101110
68	44	# 1 H image size : V image size ("310 : 174")	10	00010000
69	45	# 1 H boarder ("0")	00	00000000
70	46	# 1 V boarder ("0")	00	00000000
71	47	# 1 Non-interlaced ; Normal display, no stereo ; Digital Separate ; V sync POL is negative ; H sync POL is positive	1A	00011010
72	48	Detailed timing description # 2	00	00000000
73	49	# 2 Flag	00	00000000
74	4A	# 2 Flag	00	00000000
75	4B	# 2 Flag	00	00000000
76	4C	# 2 Flag	00	00000000
77	4D	# 2 Flag	00	00000000
78	4E	# 2 Flag	00	00000000
79	4F	# 2 Flag	00	00000000
80	50	# 2 Flag	00	00000000
81	51	# 2 Flag	00	00000000
82	52	# 2 Flag	00	00000000
83	53	# 2 Flag	00	00000000
84	54	# 2 Flag	00	00000000


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85	55	# 2 Flag	00	00000000
86	56	# 2 Flag	00	00000000
87	57	# 2 Flag	00	00000000
88	58	# 2 Flag	00	00000000
89	59	# 2 Flag	00	00000000
90	5A	Detailed timing description # 3	00	00000000
91	5B	# 3 Flag	00	00000000
92	5C	# 3 Reserved	00	00000000
93	5D	# 3 FE (hex) defines ASCII string (Model Name "N140O6", ASCII)	FE	11111110
94	5E	# 3 Flag	00	00000000
95	5F	# Dell P/N "MC196" 1st character ("G")	47	01000111
96	60	# Dell P/N " MC196" 2nd character ("1")	31	00110001
97	61	# Dell P/N " MC196" 3rd character ("8")	38	00111000
98	62	# Dell P/N " MC196" 4th character ("3")	33	00110011
99	63	# Dell P/N " MC196" 5th character ("J")	4A	01001010
100	64	LCD Supplier EEDID Revision #: "1"	01	00000001
101	65	Manufacturer P/N ("N")	4E	01001110
102	66	Manufacturer P/N ("1")	31	00110001
103	67	Manufacturer P/N ("4")	34	00110100
104	68	Manufacturer P/N ("0")	30	00110000
105	69	Manufacturer P/N ("O")	4F	01001111
106	6A	Manufacturer P/N ("6")	36	00110110
107	6B	Manufacturer P/N (If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	0A	00001010
108	6C	Flag	00	00000000
109	6D	Flag	00	00000000
110	6E	Flag	00	00000000
111	6F	Data Type Tag:	00	00000000
112	70	Flag	00	00000000
113	71	SMBUS value @ 10nits = 00	00	00000000
114	72	SMBUS value @ 17nits = 00	00	00000000
115	73	SMBUS value @ 24nits = 00	00	00000000
116	74	SMBUS value @ 30nits = 00	00	00000000
117	75	SMBUS value @ 60nits = 00	00	00000000
118	76	SMBUS value @ 110nits = 00	00	00000000
119	77	SMBUS value @ 150nits = 00	00	00000000
120	78	SMBUS value @ max nits = 00	00	00000000
121	79	Bit[1:0] 00:reserved , 01: single LVDS, 10: dual LVDS, 11: reserved Bit[2] 0: No RTC support , 1: RTC support Bit[7:3] Reserved	02	00000010
122	7A	BIST Enable: Yes = '01' No = '00' ("Yes")	01	00000001
123	7B	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	0A	00001010
124	7C	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
125	7D	(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
126	7E	Extension flag	00	00000000
127	7F	Checksum	BF	10111111

6. CONVERTER SPECIFICATION

6.1 ABSOLUTE MAXIMUM RATINGS

Symbol	Ratings
V _{in}	40.0V
Gnd	+/-0.3V
PWM, EN	-0.3V~6.0V

6.2 RECOMMENDED OPERATING RATINGS

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Converter Input power supply voltage		V _{in}	(6.0)	12.0	21.0	V	
EN Control Level	Backlight on		2.0	---	5.5	V	
	Backlight off		0	---	0.8	V	
PWM Control Level	PWM High Level		2.0	---	5.5	V	
	PWM Low Level		0	---	0.8	V	
PWM Control Duty Ratio			(20)		100	%	
PWM Control Frequency		f _{PWM}	(190)	(210)	(230)	Hz	
Converter Input Current	V _{in} =6V	I _{BL}		(720)		mA	(1)
	V _{in} =21V			(206)		mA	(2)

Note (1) The specified LED power supply current is under the conditions at V_{in} = 6V, T_a = 25 ± 2 °C, f_{PWM} = 200 Hz, Duty=100%.

Note (2) The specified LED power supply current is under the conditions at V_{in} = 21V, T_a = 25 ± 2 °C, f_{PWM} = 200 Hz, Duty=100%.

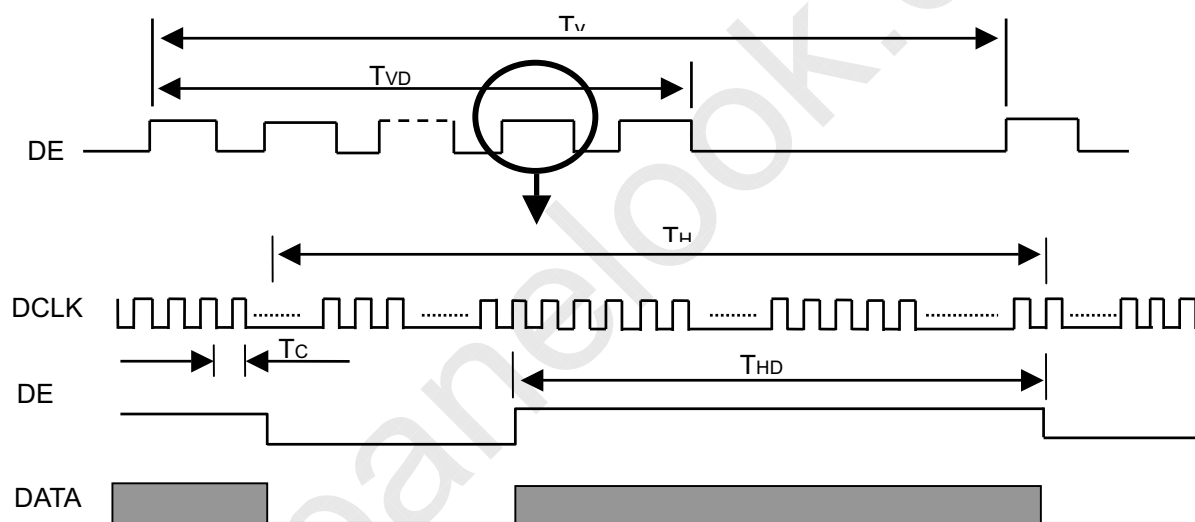
7. INTERFACE TIMING

7.1 INPUT SIGNAL TIMING SPECIFICATIONS

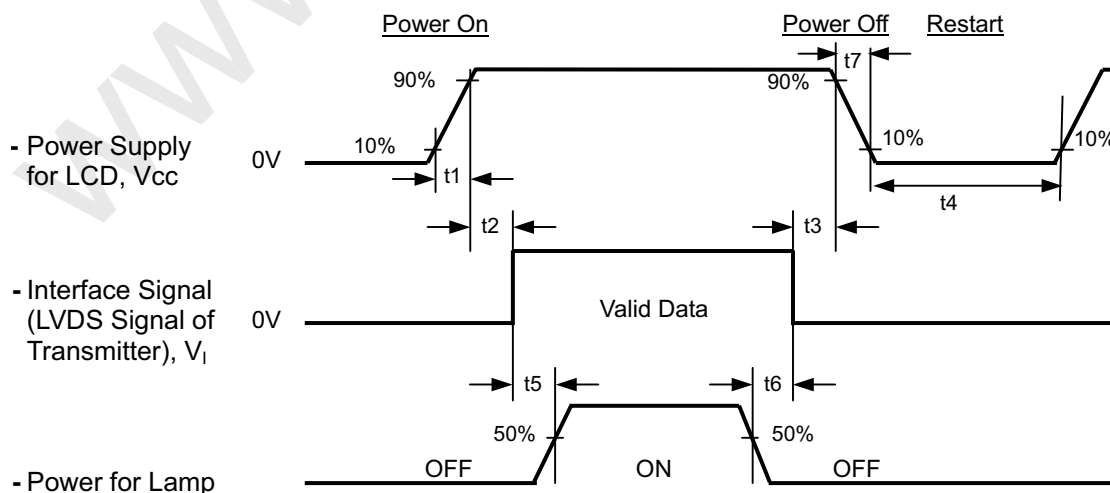
The specifications of input signal timing are as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	TBD	48.4	TBD	MHz	(2)
DE	Vertical Total Time	TV	TBD	926	TBD	TH	-
	Vertical Active Display Period	TVD	TBD	900	TBD	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	26	TV-TVD	TH	
	Horizontal Total Time	TH	TBD	1760	TBD	Tc	(2)
	Horizontal Active Display Period	THD	TBD	1600	TBD	Tc	(2)
	Horizontal Active Blanking Period	THB	TH-THD	160	TH-THD	Tc	(2)

INPUT SIGNAL TIMING DIAGRAM



7.2 POWER ON/OFF SEQUENCE



Timing Specifications:

$$0.5 < t_1 \leq 10 \text{ msec}$$

$$0 < t_2 \leq 50 \text{ msec}$$

$$0 < t_3 \leq 50 \text{ msec}$$

$$t_4 \geq 500 \text{ msec}$$

$$t_5 \geq 200 \text{ msec}$$

$$t_6 \geq 200 \text{ msec}$$

Note (1) Please follow the power on/off sequence described above. Otherwise, the LCD module might be damaged.

Note (2) Please avoid floating state of interface signal at invalid period. When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Sometimes some slight noise shows when LCD is turned off (even backlight is already off). To avoid this phenomenon, we suggest that the Vcc falling time is better to follow $(50\mu\text{s}) \leq t_7 \leq 10 \text{ ms}$.

8 OPTICAL CHARACTERISTICS

8.1 TEST CONDITIONS

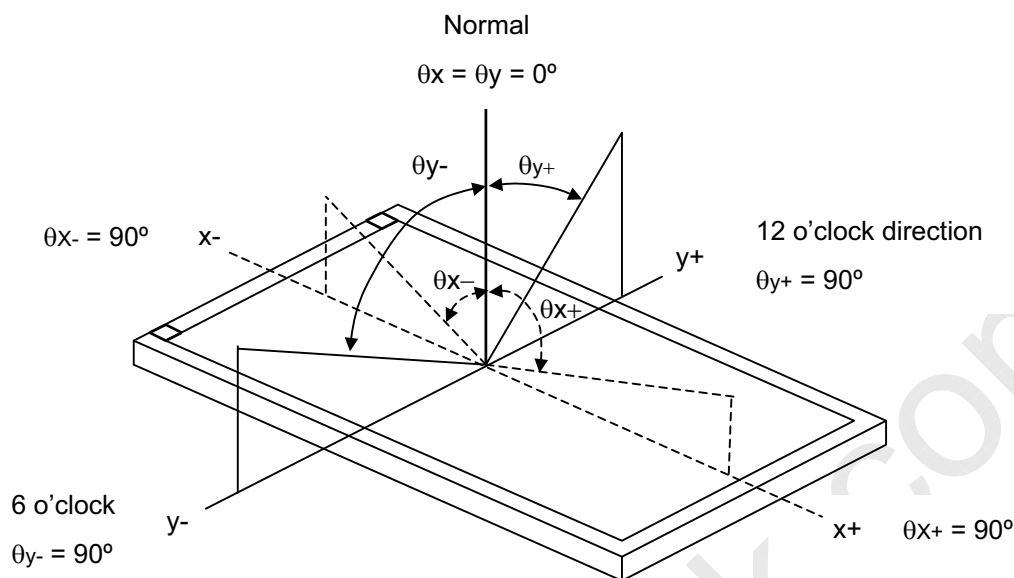
Item	Symbol	Value	Unit
Ambient Temperature	Ta	22±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V _{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current	I _L	120	mA

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

8.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_y=0^\circ$ Viewing Normal Angle	500	600	-	-	(2), (6)
Response Time		T _R		-	5	9	ms	(3)
		T _F		-	11	16	ms	
Average Luminance of White		L _{Ave}		230	250	-	cd/m ²	(4), (6)
White Variation		δW5p		-	-	20	%	(5),(6)
		δW13p		-	-	35	%	
Color Gamut		C.G		-	60	-	%	(6),(7)
Color Chromaticity	Red	R _x		-0.02	TBD	+0.02	-	(1), (6)
		R _y			TBD		-	
	Green	G _x			TBD		-	
		G _y			TBD		-	
	Blue	B _x			TBD		-	
		B _y			TBD		-	
	White	W _x			0.313		-	
		W _y			0.329		-	
Viewing Angle	Horizontal	θ _{x+}	CR≥10	60	70	-	Deg.	
		θ _{x-}		60	70	-		
	Vertical	θ _{y+}		50	60	-		
		θ _{y-}		50	60	-		

Note (1) Definition of Viewing Angle (θ_x , θ_y):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

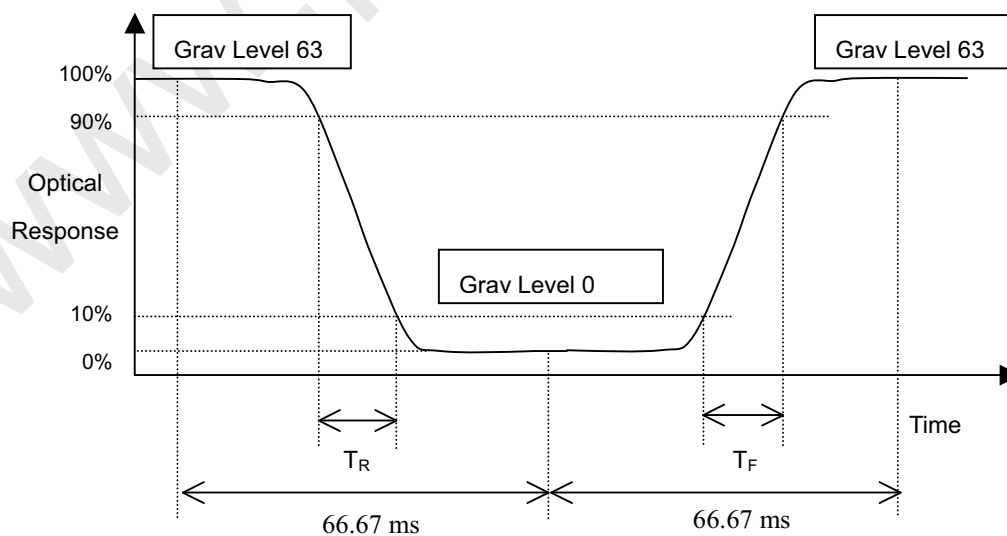
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (55)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

Note (3) Definition of Response Time (T_R , T_F):



Note (4) Definition of Average Luminance of White (L_{AVE}):

Measure the luminance of gray level 63 at 5 points

$$L_{AVE} = [L(33) + L(37) + L(55) + L(73) + L(77)] / 5$$

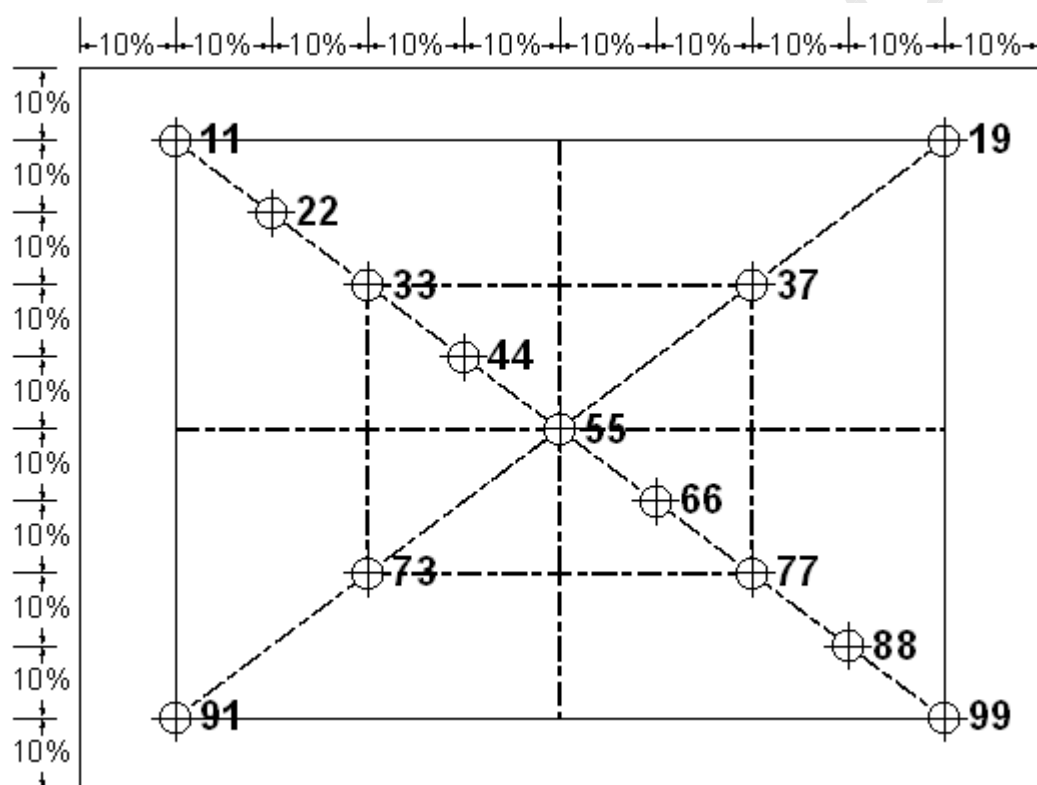
$L(x)$ is corresponding to the luminance of the point X at Figure in Note (5)

Note (5) Definition of White Variation (δW_{5p} , δW_{13p}):

Measure the luminance of gray level 63 at 5, 13 points

$$\delta W_{5p} = \{1 - [\text{Minimum } [L(33) + L(37) + L(55) + L(73) + L(77)] / \text{Maximum } [L(33) + L(37) + L(55) + L(73) + L(77)]]\} * 100\%$$

$$\delta W_{13p} = \{1 - [\text{Minimum } [L(11) \sim L(99)] / \text{Maximum } [L(11) \sim L(99)]]\} * 100\%$$





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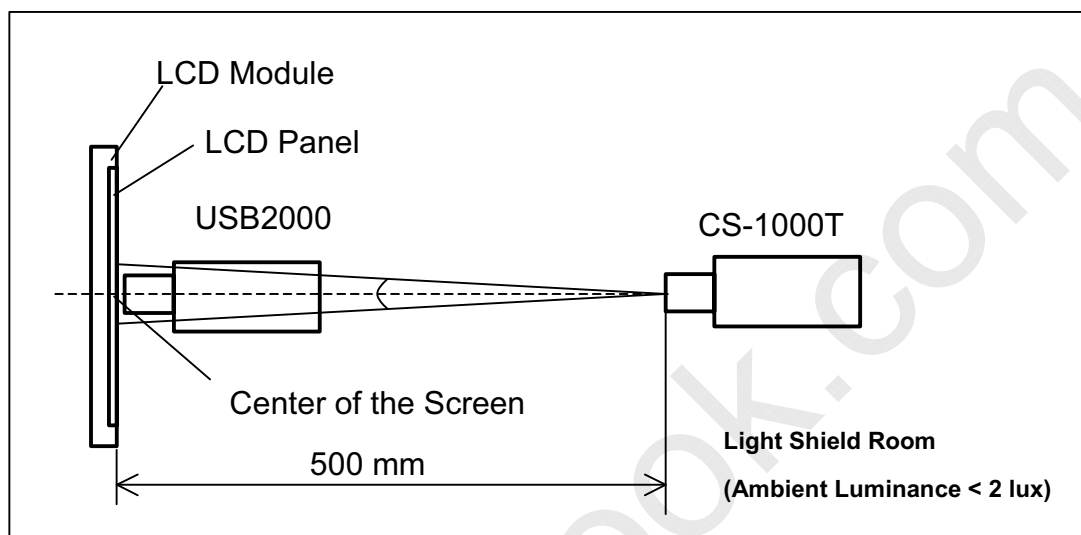
Issued Date: Sep. 02, 2008

Model No.: N140O6 - L02

Tentative

Note (6) Measurement Setup:

The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (7) Definition of color gamut (C.G):

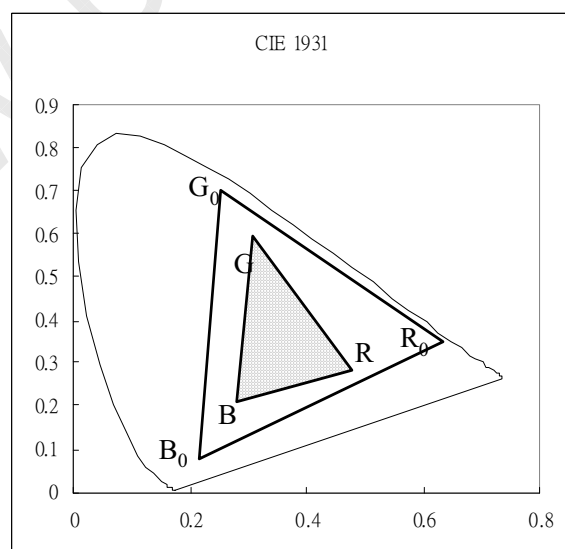
$$C.G = R G B / R_0 G_0 B_0 \cdot 100\%$$

R_0, G_0, B_0 : color coordinates of red, green, and blue defined by NTSC, respectively.

R, G, B : color coordinates of module on 63 gray levels of red, green, and blue, respectively.

$R_0 G_0 B_0$: area of triangle defined by R_0, G_0, B_0

$R G B$: area of triangle defined by R, G, B



9 PRECAUTIONS

9.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
- (5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (9) Do not disassemble the module.
- (10) Do not pull or fold the lamp wire.
- (11) Pins of I/F connector should not be touched directly with bare hands.
- (12) To avoid wireless noise interference, please keep the antenna away from LCD control board.

9.2 SAFETY PRECAUTIONS

- (1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (3) It may reduce the display quality if the ambient temperature is lower than 10 °C. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

9.3 OPERATION PRECAUTIONS

- (1) Do not pull the I/F connector in or out while the module is operating.
- (2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This



can prevent the CMOS LSI chips from damage during latch-up.

- (3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

9.4 OTHERS PRECAUTIONS

- (1) When fixed patterns are displayed for a long time, remnant image is likely to occur.

9.5 SAFETY STANDARDS

The LCD module should be certified with safety regulations as follows:

- (1) UL60950-1 or updated standard.
- (2) IEC60950-1 or updated standard.
- (3) UL60065 or updated standard.
- (4) IEC60065 or updated standard.

10 PACKAGING

10.1 CARTON

Box Dimensions : 435(L)*350(W)*320(H)
 Weight: Approx. 9.6kg(20 module .per. 1 box)

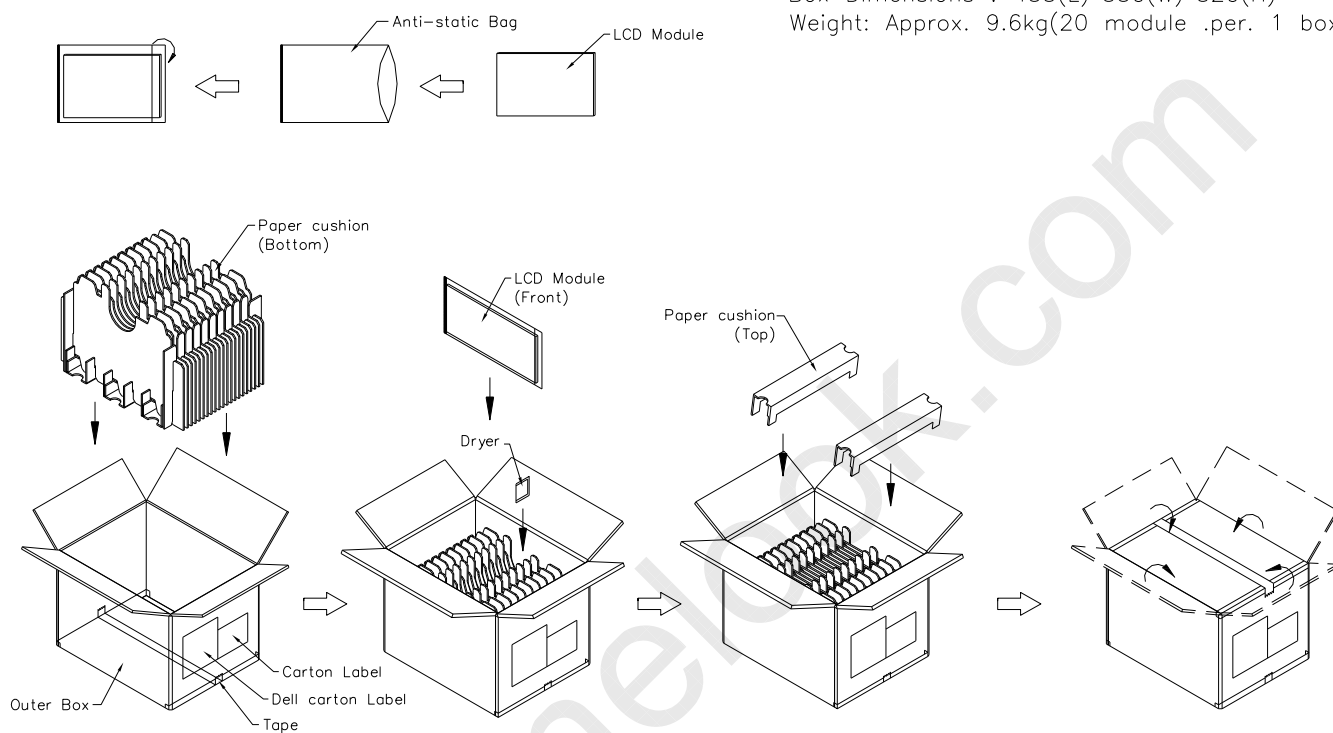
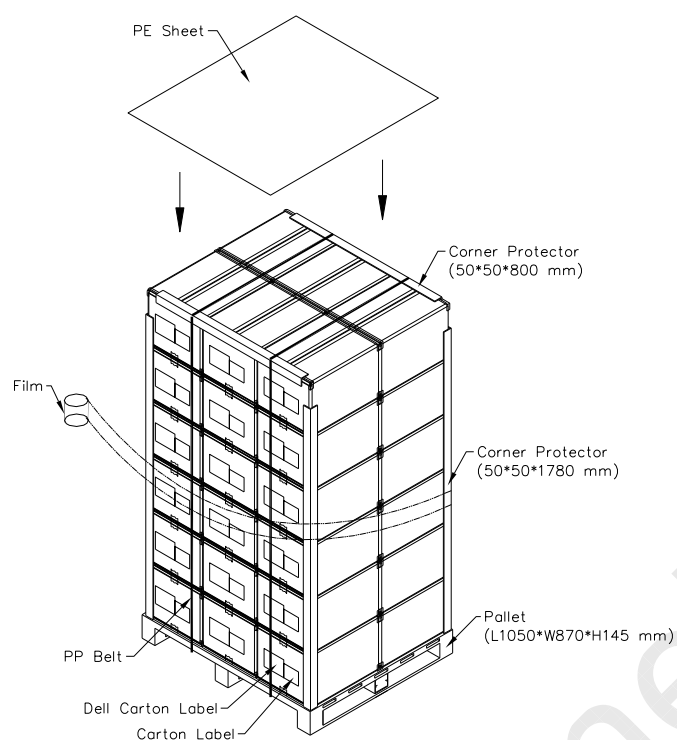


Figure. 10-1 Packing method

10.2 PALLET

Sea & Land Transportation



Air Transportation

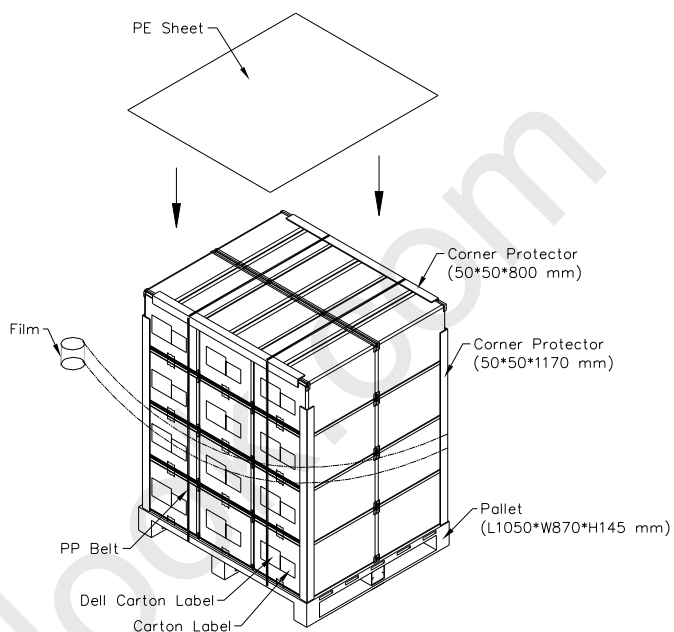


Figure. 10-2 Packing method

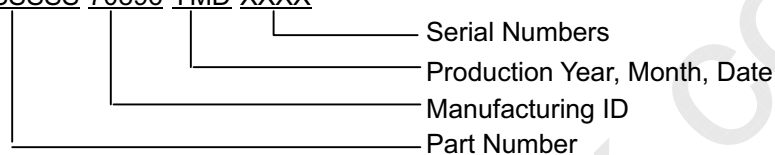


11.2 CMO MODULE LABEL

Dell 2D label contains information as below:



(a) Serial ID: TW-0SSSSS-70896-YMD-XXXX



(b) Production location: Made in XXXX.

(c) Revision code: X00, X10, X20, A00..etc.

11.3 CMO CARTON LABEL

CMO carton label is as below:



(a) Production location: Made In XXXX. XXXX stands for production location.



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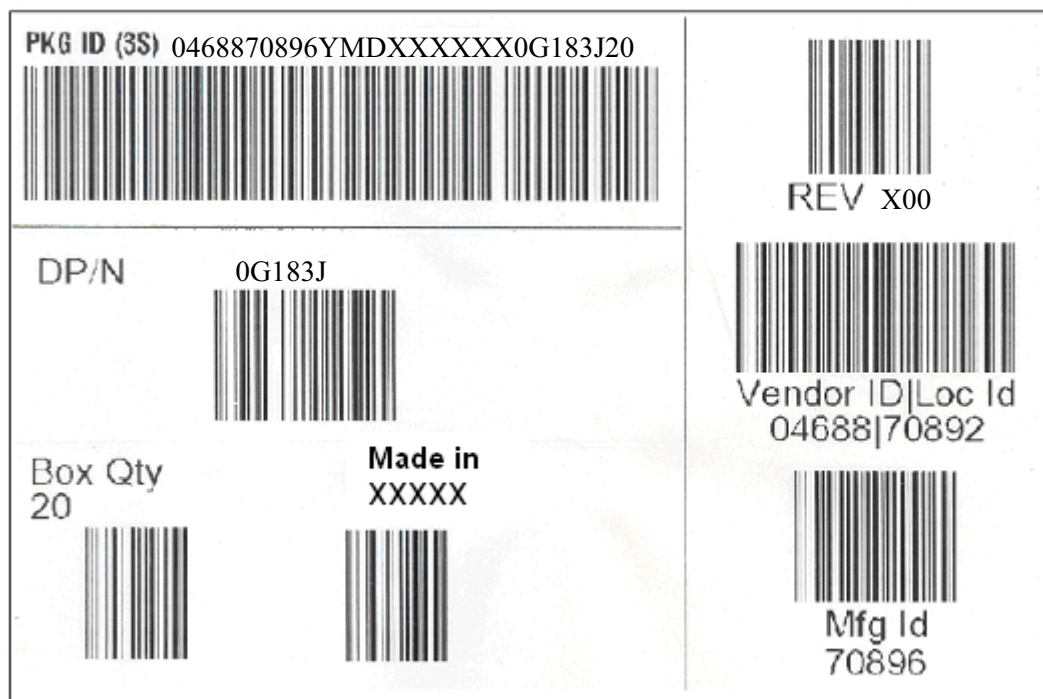
Issued Date: Sep. 02, 2008

Model No.: N140O6 - L02

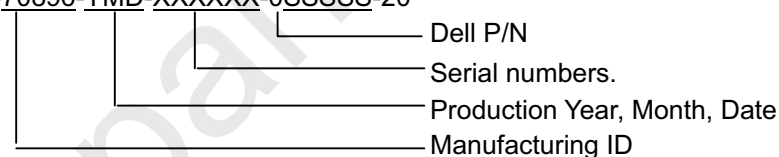
Tentative

11.4 DELL CARTON LABEL

Dell carton label contains information as below:



(a) PKG ID: 04688-70896-YMD-XXXXXX-0SSSSS-20



(b) Production location: Made in XXXX.

(c) Revision code: X00, X10, X20, A00..etc.

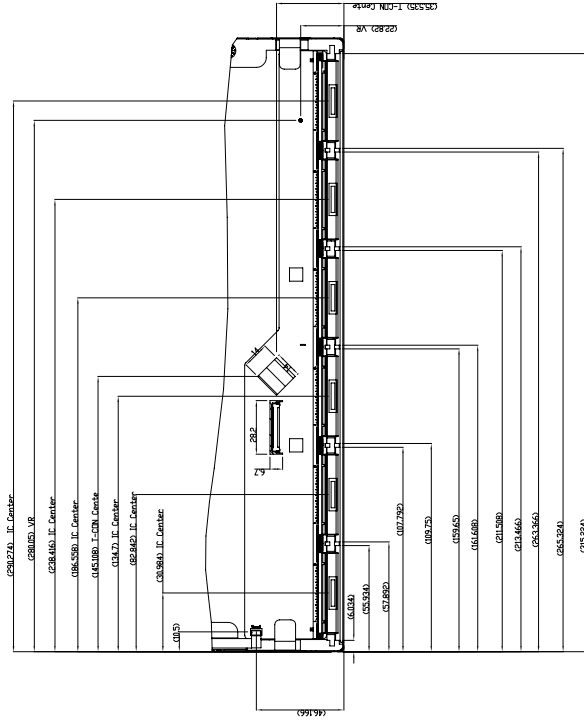
TITLE		ASTY MIDDLE_N400B-LR		REV 1		REV 17	
Approved	SKANNA	Drawing No.	N402HMES				
Decided	JACKSON	Part No.	TM				
Drawn	LEON	Material	10	Sheet 1 / 1		A8	
Designed	LEON	Date	12-Sep-2008	Scale	1:1	Version	01

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NOTES:

1. MAX SCREW LENGTH 25mm.
2. MAX SCREW TORQUE 20 kg-cm.
3. MAXIMUM PERMISSIBLE TORQUE IS NOT TO EXCEED 10% OF THE TENSILE STRENGTH OF THE EQUIVALENT UNFINISHED SCREW.
4. CONNECTOR CONNECTED TO THE PANEL SHALL BE 14-16 IN. EQUIVALENT.
5. GAP BETWEEN PANEL AND PANEL MAX 15mm.
6. In order to avoid abnormal display, pooling and white spot, no overlapping is suggested at cables, antennas, covers, V.M., V.M. or other foreign debris over CDP driver IC, TUN and VR locations.



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